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⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

STEEL FOR STRUCTURES.

By Ewing Matheson, M.Inst.C.E.

The object of this Paper was to state the present position which steel occupied, as compared with iron, as a material of construction; and to examine the reasons why, while steel was rapidly superseding iron for ships and boilers, it was so seldom used for bridges. Steel possessed the important advantage of a strength one and a-half to twice that of iron, as well as superior elasticity and ductility; and, owing to the method of manufacture, plates and bars of the usual kind could be made of steel in much larger pieces than was possible with iron, thus avoiding the numerous joints which the smaller pieces involved. The special treatment necessary for steel could soon be learnt by workmen accustomed to iron, and the tools and machinery of a factory could be used for either metal. In regard to wasting by rust, sufficient time had hardly elapsed to prove positively the durability of steel as compared with iron, but at present it appeared as if the difference, if any, was in favour of steel.

Because of its greater strength, structures equal to iron could be made of less weight in steel; and in regard to ships, this saving allowed a corresponding increase in cargo-carrying capacity, or a reduced immersion. In boilers, plates whether of steel or of iron could not conveniently be of more than a certain thickness, and the working pressure was limited accordingly; but the superior strength of steel permitted a working pressure of steam one-third greater than in boilers of iron, thus allowing a saving in the space occupied for a given power, and greater economy in fuel. In regard to girders or bridges, if strength and elasticity were assured, there was not the same necessity for the great ductility which in ships was so important to resist concussion; but the rules of the Board of Trade, which controlled railway structures in this country, allowed working strains on the parts of steel bridges based on the extremely ductile steel used for ships. That was to say, while the maximum strain allowed on iron was 5 tons per square inch of sectional area, a strain of only 6½ tons was allowed on steel. By this limitation the Engineer, in designing bridges, was unable to take full advantage of steel; and as, moreover, for various secondary reasons, the thickness of parts in a steel structure could not be reduced, in proportion to those of an iron structure, quite so much as even the permitted strains allowed, bridges of moderate span could not be made so cheaply of steel as of iron, so long as the cost of the material exceeded, as at present, that of iron in a proportion equal to that of the greater strains permieted. Until the present time, the cases in which steel had been profitably used were those in which, because of difficult transport in new countries, lightness was of great value, and those where, owing to great length of span, the weight of the material itself, as distinct from the dead and moving load it had to carry, imposed the principal strain, a compound saving being thus afforded by the use of steel. In this way, while a saving in weight of only 12 per cent. could be obtained in a bridge of 50-feet span, a saving of 30 per cent. could be obtained in a bridge of 500-feet span. With the present prices of iron and steel there would be a loss by using steel in the small span and a gain by using it in the large span. But while there might be no immediate pecuniary saving by using steel, there was, owing to the very moderate strains permitted on this new material, a much greater margin of safety than in iron. Hence the question arose whether, even although the cost of steel bridges of moderate span might be greater than that of iron bridges, they should not be preferred, and their use enforced, because, if measured by units of strength and durability as well as of money, they would be cheaper eventually.

There were several means by which the use of steel might be extended. In the first place, the experience gained during the last few years, as to the certainty of quality and the readiness with which it could be treated, had not yet spread to all concerned, especially to Engineers abroad, who awaited some authoritative affirmation to set against the records of early mistakes, misapplications and failures. The proper treatment of steel had now been thoroughly investigated, and the circumstances under which the metal was damaged, by punching holes and other manipulation, were well understood. But there was also needed some ready means of verifying quality. This was far more necessary in steel than in iron, because in the latter the range within which strength might vary was only one-sixth, whereas steel had a much wider range. Again, the mere fact that iron had been rolled into shape ensured a certain minimum of quality, while if steel chanced to be bad it might be one-half weaker than was wanted. An authoritative brand or hall-mark seemed necessary, if steel was to be universally accepted, and the author suggested that some mark should be adopted, as denoting quality and kind, the addition of the particular trade-mark of each maker serving as a warranty.

But in order to encourage a further use of steel, the Board of Trade rules should be altered. While a certain minimum of strength and ductility might be demanded, the present limits to the maximum straining should be amended, so that, instead of 6½ tons per square inch, 8 tons might be allowed,—an increase amply justified by the experience acquired during the last few years. If this was done, the greater demand would almost certainly have the effect of bringing the price nearer to that of iron, as had been the case with rails. The author set forth the present rules of the English Admiralty and Lloyds' in regard to steel for ships, and directed attention to the different rules of the French Admiralty, to exemplify the alterations which he proposed. As it was by means of a Royal Commission that the present strains on steel were permitted, it was time that another Commission should be appointed to inquire into the facts more recently acquired, and to grant more liberal rules for the future. With an extension of the present limit of 6½ tons, there would be such a demand as would lead to improvements in the manufacture, increase the output, and reduce the price of steel. The whole calculation would then be altered, and when steel might not only be worked to 8 tons strain per square inch, but the difference in price over iron was less than it was now with 6½ tons, then, but not till then, would the era of steel structures have arrived.

DISINFECTING BY STEAM.

Hitherto apparatus for disinfecting have been framed for applying dry heat, either with or without the aid of chemicals; but the one of which we are about to treat marks an important departure from former ideas, inasmuch as steam or moist heat is made to take the place of the dry caloric. The invention of an individual who is in a measure connected with an industry, bringing practical knowledge to bear upon it, is commonly more effective for the purpose than that introduced by a scientific theorist, and the present is an illustration in point. Mr. Washington Lyon, the inventor and patentee of the steam disinfector, is a partner in the firm of Messrs. J. A. and W. Lyon, who, as we are informed, for two generations have carried on an important business in the Old Kent Road as bleachers, cleaners, and calenderers of all kinds of textile fabrics. Their trade has been extensively amongst the large shipping companies, every particle of whose linen, from bedding to a table napkin, has from time to time passed through their hands for cleaning, disinfection, or renovating.

Thus, adopting the statements of a recent number of the *Sanitary Record*, Mr. Lyon's attention has been turned to what is now recognised as one of the most important practical questions of public health. So far back as the year 1867, when cholera was doing its worst in the metropolis, he was elected Chairman of the Committee formed in his own district (where at one time it threatened to become serious), to endeavour to arrest its progress; and from his connection with the business before-named, he was not only enabled to offer valuable advice, but assisted materially by distributing disinfectants gratuitously, and helping, in all that the knowledge of the day enabled him to, to battle with the disease. From that time his thoughts were turned to the subject; but it was not until some three years since that he brought them into actual practice. One of the firm's principal clients, a large steamship company, who carried a great number of emigrants, had become so infested with vermin that it was prejudicing their interests very materially, and first-class passengers were seeking other means of transport. Every means that could be suggested had been tried to purify the ships, and as much as £1,000 had been expended on one, between voyages, to rid her of the noxious intruders, but she had scarcely passed down Channel on her outward voyage before matters were as bad as before, and Messrs. Lyon were appealed to, on the return home, to render assistance. Mr. Lyon had in the interim completed his first disinfector, and had practically proved his ideas were correct, and he very soon eradicated the vermin from the ship by the means we shall presently describe. We shall not trouble our readers with all the details of the first experiments, but introduce them at once to the apparatus in its completed form, as now in actual use at the Old Kent Road Works, the Endymion hospital ship, and elsewhere. The disinfector can be readily removed from place to place with the assistance of one horse. The machines are manufactured for the patentee by Messrs. Manlove, Alliott, Fryer, and Co., the eminent engineers of Nottingham and Rouen, who are themselves makers of apparatus for destroying the refuse of towns, &c., several of their appliances being now in successful operation in some of the largest inland towns in the North. The disinfector is made of the best Low Moor iron, is oval in form, and has an outer casing or jacket, into which the steam is first admitted, for thoroughly drying and heating the cleansing chamber. During this time, the articles to be disinfected are placed in position, the door is closed and hermetically sealed, and the steam, by means of another pipe carried through the jacket, is turned into the interior chamber. Gradually a gauge, placed on the outside, is seen to rise, registering successively five pounds, ten pounds, and so on, pressure of steam to the square inch, until twenty pounds are attained, giving 270° Fahrenheit; the pressure in the outer casing having been raised to 30 lbs. By this time a half hour has probably elapsed, when the steam is turned off from the disinfecting chamber into a well or tank, or may be discharged into the atmosphere; a few minutes more are allowed for the articles to become thoroughly dried, which is accomplished by means of the steam in the jacket or casing, the door is opened, and the articles taken out as soon as the heat allows them to be handled. This is the sum total of the process, and it only remains to inquire into its effects, and what advantages it possesses over the hitherto commonly adopted plan of dry heat with or without the aid of chemicals. It is a fact well known that very few fabrics will bear a dry temperature of more than 250° Fahr.; beyond that they become scorched or singed, and are virtually destroyed. At the same time, for the purpose of thorough disinfection it is necessary to reach that degree; and the question arises, does that heat always effectually attain the desired end? Recent investigations have proved that it does not, and it is not certain that the highest amount of dry heat to which it is safe to subject many fabrics to, does not tend, if destroying insect life itself (which is also problematical), to assist to develop or bring to maturity the germs of life in the ovum. If we admit this, and we can scarcely refuse to do so, does steam, which can be utilised at so much higher a temperature, effect the desired object? Of this there is not a doubt.

Two years of constant work, in which articles of the most heterogeneous description, and in almost all stages of danger to health, either from disease or other causes, have been operated upon by this means, sometimes under the actual observation of eminent professional men, at others by the superintendence of the patentee himself, have proved the truth of the idea. The microscope has been brought into requisition after disinfection, and has shown conclusively that no germs of life, bacteria, &c., were to be found. Even large-sized grubs or insects have been utterly destroyed and disorganised, while ova or eggs have become melted, or utterly destroyed. But while effectually accomplishing perfect disinfection, the Lyon disinfector does not destroy or injure the most delicate article submitted to its powerful agency. This is an advantage which must always enter into the calculations of those who, in their official capacity, are called upon to protect the public health, and at the same time to guard the public or local purse.

To show the necessity existing in some parts for an effectual means to arrest the dissemination of disease, we may call attention to a proceeding which took place in Hungary some few months since. Fearing the introduction of the plague from Russia, the sanitary authorities conceived the idea of adopting some plan by which letters and other imported objects might be rendered harmless. Many experiments were tried under the guidance of the most able professors, and some bacteria were subjected to the influence of dry heat, but it was found that while the highest heat considerably retarded decomposition, certain kinds of bacteria could not be destroyed, therefore it did not fully obviate decomposition. But to supplement this, it was advised that the maximum temperature should be applied in connection with vapours of carbolic acid, and then the living organisms were apparently killed. This only goes to prove what we ourselves know, that dry heat is not a certain safeguard for the disinfection of papers or letters.

Desirous to see the effects of steam upon delicate fabrics, as well as upon those articles acknowledged to be bad conductors of heat, such as made up bedding, &c. (and it must be remembered that anything treated by Mr. Lyon's process does not require to be taken to pieces or unmade), we recently paid a visit to Messrs. Lyon's works, and were present during the whole process. Not to recapitulate our former description, we may say that the steam brought from the boiler by an ordinary tube was admitted to the jacket. A mattrass was placed in the receiver, and numerous articles of the most varied description, some of a most delicate character, such as silken tassels, borderings for curtains of varied colours, letters in coloured inks, books, and a quill pen that we are now using, were subjected to its influence. A thermometer was forced into the centre of the mattrass, and after the opening of the disinfector, registered 260° Fahr. The small fabric articles appeared just the same as when put in, the gloss remained upon them, as if they had just left the loom, and the letters and books had in no degree altered, yet they had been subjected to a damp atmosphere under a pressure of nearly thirty pounds to the square inch, for nearly half an hour. The principal object of the outer casing is to prevent the condensation of steam in the disinfecting chamber, obviating the wetting that would otherwise occur to the articles under treatment, and the consequent deterioration of gloss and colour.

We now direct attention to a disinfector for hospitals or any building where a permanent apparatus may be erected. As a safeguard against contagion, it is intended to be fixed between two rooms, one half in each, with swing doors to the disinfector, pivoted in the centre, and opening at either end. The object here sought to be obtained is that perfect immunity from danger of contagion of the most remote character may be secured. The infected articles are placed in the apparatus in the one room by the individual who has collected them, and are taken out in an adjoining one, when disinfected, by another person who has had nothing to do with them in their infected state.

A simple suggestion or two, and we must leave the Lyon disinfector to attain that position in the sanitary world that its merits deserve. Why should not such an apparatus on a smaller scale be made for the use of schools and other public institutions apart from hospitals, workhouses, &c.? It would be of the most useful character on many occasions, and for varied purposes. It could, of course, only be employed where steam was obtainable; but now that hot-water apparatus and high pressure boilers are to be found in nearly all establishments where large numbers of persons live and have to be provided for, it would be an easy matter to utilise the steam that is now wasted, in operations of the character we have discussed.

An improved *car coupling*, which combines with it a cushioned bumper and furnishes a yielding drawhead, has been patented by Mr. Darwin S. Walrath, of Ingham's Mills, N. Y. In this coupling the frame of the device and drawhead are mounted in slots formed in the beams of the car platform, with a spring between them, and both have a limited longitudinal movement in opposite directions. When the cars are ready for coupling, a crossbar, which engages the connecting bolt, rests on a table formed on the bumper head which has been forced forward by the spring of the intermediate bumper when the cross bar was raised by an uncoupling lever. The ears having been brought together the connecting bolt or link enters the bumper head and forces it back against the bumper, which is a double or compound one, the springs of which absorb the concussion. In the meantime the crossbar has dropped from its supporting table into position in front of a projection on the connecting link, which is thereby prevented from being withdrawn. One of the springs of the compound bumper is heavier than the other, so that the power for drawing the car will come against the rearward thrust of that spring, which thus furnishes a yielding draw for the car.

AIR REFRIGERATING MACHINEEY AND ITS APPLICATION.

By J. J. Coleman.

At a recent Ordinary Meeting of the Institution of Civil Engineers, this paper, then read, first dealt with the thermodynamic laws regulating mechanical refrigeration as successively enunciated by Joule, Sir William Thomson, Rankine, Clerk-Maxwell, and others, particularly pointing out the fact that atmospheric air having lately been proved to be the vapour of a liquid, there was no essential difference in the theory of machines for producing cold, whether air, or the vapours of such substances as ether and ammonia were employed. Any machine which was worked through the medium of a readily-condensable vapour had its action limited by the boiling point of the volatile liquid, and therefore it was impossible with such machines to get so large a range of cooling in one operation as could be accomplished by air. The low temperatures which Pictet required for the liquefaction of oxygen and hydrogen were obtained in stages, first by ebullition of liquid sulphurous anhydride in vacuo, producing sufficient cold to liquefy carbonic acid gas at a pressure of 4 atmospheres, and then in taking advantage of the still greater cold produced by the ebullition of the liquid carbonic acid gas in vacuo. There was, however, no reason to suppose that the same or much lower temperatures could not be obtained by the compression and expansion of air in a single operation.

The boiling point of ether in the air was 95° Fahrenheit, so that to use it as a medium for refrigeration it must be evaporated in vacuo—that was, a pump was required which caused it to boil rapidly, and it became cooled as the vacuum increased; but the cooler it became the less slowly it evaporated, until, when its temperature sank to a little below zero, evaporation ceased, although the pump might be maintaining the vacuum. It followed that if the brine, which was usually the medium being cooled, returned back to the boiling ether without having picked up heat from the substance being cooled, the action was gradually diminishing. This phenomenon was very likely to occur when the brine cooled by such a machine circulated in pipes through a chamber containing atmospheric air, more or less saturated with aqueous vapour, and as would be the case with a chamber containing fresh meat being cooled. The brine-pipes in such circumstances became externally coated with a non-conducting covering of ice, which, unless removed, accumulated to the extent of several inches in thickness, thus interfering with the transfer of heat, and preventing the room from being reduced to a lower temperature than the freezing point of water, or the melting point of the exterior surface of the crust which surrounded the pipes, whilst the brine was liable to be returned to the evaporating ether at lower temperatures than it should for the economical working of the machine. The same remarks applied to the employment of sulphurous anhydride and of ammonia, the limiting action in the case of ammonia, which was considered the most effective in practice, being about 35° below zero Fahrenheit when it was employed at atmospheric tension, as in Carré's process, or in Reece's process, though of course much lower when evaporating into a vacuum, as in Professor Lindé's machine.

Almost all the statements as to the performances of these machines referred to their employment under favourable conditions, namely, the cooling of water or other fluids, or the making of ice, in which the temperature of the saline solution or glycerine transferring the heat never need sink below 20° Fahrenheit. When they came to be employed for cooling solids, such as masses of meat, to temperatures below freezing point, great practical difficulties occurred in the transfer of the heat through the non-conducting air in which the meat was suspended to the pipes containing the brine. unless such pipes or other eqnivalent circulating apparatus were brought into close proximity to the solid masses. On board ship such arrangements were almost impossible if the ship's hold had to be employed for general cargo on the outward voyage, and in any case networks of such circulating apparatus were inconvenient and liable to leakage and injury of the cargo.

From these considerations, even if the use of dangerous chemicals on board steamers were allowable, it was apparent that cold-air machines, in which air was first compressed and then expanded, were the most convenient form of refrigerating apparatus; and it was also clear that they were the most convenient form of machine for cooling the air of apartments generally.

The great enemy of cold-air machines was friction encountered in the working of the machinery, particularly that which resulted in the development of heat in the expansion cylinder. In regard to the prime cost of machinery, experience had proved that not much difference existed for a given amount of cooling power whichever system of refrigeration was adopted.

The general principles upon which cold-air machines should be constructed, as regarded the arrangement of cylinders, had been laid down by Rankine and Sir W. Thomson in 1852, the former at the same time proposing a form of thermo-dynamic machine for the reverse process of heating buildings, and various practical attempts to make cold-air machines successful, and which were minutely described by the author, were made between that year and the year 1877, none of them being thoroughly successful, excepting the machines of Mr. Kirk, introduced in 1862, and which was not a machie for circulating cold-air, but for producing ice or cooling liquids by the alternate compression and expansion of a confined volume of air. These attempts were failures, chiefly because of disregard or ignorance of the peculiar behaviour of aqueous vapour which formed a constituent part of the atmosphere.

An attentive consideration of the matter upon general principles had led to the following conclusions:—

1. That atmospheric air was really not air alone, but a mixture of aqueous vapour and air, and that when such mixture was compressed into pipes surrounded externally by water of the same temperature as the air before compression, the invisible vapour of the air became condensed in the direct ratio of the compression, in virtue of the law of physics demonstrated by Dalton, and expressed by the statement that a cubic foot of air in contact with water contained exactly the same weight of vapour, whatever might be the density of the air. If the density was increased, the vapour liquefied—if it was diminished, water evaporated into the air.

2. Therefore compressed atmospheric air of usual humidity, was not made wetter by injection of water, provided the surplus water was run off continuously by automatic traps, air being actually dried by compressing it in contact with water, removing the water and expanding it.

3. Direct injection was the quickest and most effective method of cooling air to the temperature of the water, which was a condition necessary to the working of a machine with the least expenditure of power.

4. Injection of a shower of water into freshly compressed air tended to settle the fog caused by the sudden condensation of the invisible atmospheric vapour, thus facilitating its removal by traps.

5. That whilst the direct injection of water was desirable for cooling the air to the temperature of the water, it was not absolutely essential, if the compressed air was passed through a sufficient number of pipes surrounded by cooling water, the ultimate result being that the compressed air could only be reduced to the temperature of the water, which was not sufficient to liquefy the vapour usually contained in the air, except the air pressures employed were excessively high. which was fatal for working a machine economically.

6. That every pound of vapour unnecessarily condensed liberated as much heat as would raise about four thousand times its weight of air 1° Fahrenheit, and that air absolutely dry was a condition that would abstract the fluids of animal tissue, and indeed was a phenomenon unknown in nature, the degree of humidity being generally over 50°, even in what was, in common parlance, called "dry air."

7. That a convenient way of liquefying such vapour was to apply a portion of the cold air produced by the machine to the external surface of the pipes conveying the compressed air already cooled by water to the cylinder in which it was to be expanded, the liquid being removed by automatic traps.

The last principle had not been applied in practice in this country prior to the author adopting it in conjunction with Messrs. Bell.

The author commenced to design machines in 1877 which afforded a uniform degress of dryness in the cold air, suitable for carrying provisions without drying up their juices, and used principally for the importation of meat from the United States. The experimental machine which brought the first cargo from New York, in 1879, and the first cargo of meat from Australia, in 1880, was described in detail, as also the construction of the machines generally employed in Transatlantic traffic, which had a pair of compressors of 16 inches diameter, steam cylinder of 18 inches diameter, an expansion cylinder of 17 inches diameter, and 2 feet length of stroke. These machines had been worked continually from leaving New York to the arrival in British waters, and had brought over, to the end of 1881, meat to the value of between £2,000,000 and £3,000,000 sterling. Several machines constructed for land purposes and erected at Sydney, Barrow-in-Furness, Waterford, Limerick, and Hamburg, &c., were described with the cooling chambers attached; also machines erected in the West Indies, on the Cunard liner "Servia," and on the Spanish mail steamer "Antonio Lopez." A list of the machines at work in the Australian traffic was given, which included those on the Cuzco, Dunedin, Chimborazo, Lusitania, Kaiser-i-Hind, Rome, and Carthage, erected by the Bell-Coleman Company: and those on the Protos, Europa, Clyde, Orient, Garonne, and Sorrento, erected by other makers, the sizes of the cylinders, and comparative powers being described, and which had brought into the United Kingdom frozen meat to the value of about £50,000 sterling.

The latter part of the paper dealt with the efficiencies of cold-air machines and formulæ for their calculation; and stated, that air-refrigerating machines of the larger sizes were giving an efficiency not much different from that of ether and ammonia machines; and it also pointed out the probable future development in ventilating and cooling buildings, especially in India and other tropical countries, which, by calculation, should not cost more than one-tenth of a penny per head per hour.

An *improved whip* has been patented by Messrs, Henry Mullen and James Noble, Jr., of Westfield, Mass. The core of this whip is formed of a leather or rawhide piece at the butt and a whalebone piece at the lash end, so that the advantage of a whalebone whip is retained, while the cost greatly reduced.

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Editor: 21, Cockspur Street, Charing Cross, S.W.

And if for notice in the next issue, before the 25th instant.

THE INVENTOR'S INSTITUTE,

4, ST. MARTIN'S PLACE, TRAFALGAR SQUARE. LONDON.

Established 1st May, 1862.

Past Presidents:

Sir David Brewster, K.H., LL.D., F.R.S., &c., from the establishment of the Inventors' Institute, till his decease, February, 1868. Lord Richard Grosvenor, M.P.

SESSION 1881—1882.

Members' Meeting, March 23rd, 1882.—T. Morgan, Esq., "The Present State of the Patent Laws, and Proposed Amendments thereon."

Subscriptions are payable to Mr. G. A. Stretton, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. Campin, Sec.

Proceedings of the Institute.

Executive Council, March 2, 1882.

Admiral Selwyn announced that he had obtained a special interview with His Grace the Duke of Manchester (a Vice-President of the Institute), and signified to him that the Members of the Inventors' Institute much desired his taking the position of President. After pressing upon His Grace the desirability of an eminent member of the House of Lords being at the head of the Inventors' Institute in the present state of Parliamentary proceedings, the Duke agreed to become President.

The meeting unanimously accepted him as President.

The Acting Treasurer presented the state of the Finances, which were found to be satisfactory. The question of papers to be read at the Members' Meetings was discussed, and papers were promised by Mr. T. Morgan, Mr. M. Zingler, Dr. McGrigor Croft, Mr. F. H. Varley.

The addition of suitable names to the Council was also considered.

Monthly Notices.

Prof. Dudley states that a rod of iridium, prepared by the process introduced by Mr. J. Holland, of Cincinnati, has been used successfully in an electric lamp for sixty hours without change or loss of weight.

Adam von Burg, the Vice-President of the Vienna Academy, died recently, aged eighty-five. He will be remembered from his mechanical and mathematical papers, which have from time to ttme excited much attention.

The Iron and Steel Institute have arranged to hold their annual meeting this year in Vienna, commencing on the 20th of September. A visit will be paid to Gratz, the capital of Styria, and other places of metallurgical interest.

Accumulators—M. Planté has found that the process of forming his accumulators is shortened by applying heat while charging. Between 70° and 80° C. the resistance is much less, but there is no advantage in exceeding those limits.

Diamonds.—Mr. O. A. Derby, in the *American Journal of Science* for February, has an interesting paper on the geology of the diamond, giving the results of his researches in Brazil. He arrives at the conclusion that the formation in which diamonds are found is of the Cambrian age.

Telephone in Mining.—It is interesting to note that the telephone has been applied at Dolcoath copper mine, near Camborne, Cornwall, between the surface and the extreme depth of 350 fathoms. This is the deepest metal mine in this country, and Capt. Josiah Thomas pronounces the result to be in every way most satisfactory.

Electricity and Fire Danger.—Dr. Siemens publishes in the January number of the *Electrotechnische Zeitschrift* a lecture "On Electricity and the Danger from Fire." This is a matter demanding closer attention than it has yet received. There are especial dangers to be guarded against in the introduction of electricity into collieries. Dr. Siemens suggests that the light might be conducted through the workings by reflectors, or the luminous paint might be employed, which could be charged with radiance at a central lamp, and distributed to the workings.

The Comptes Rendus de l'Académie des Sciences, No, 6, for the 6th of February, is devoted to the *seance publique annuelle.* M. Ad. Wurtz, the president of the Académie, delivered his address, which was naturally largely devoted to the applications of electricity, though embracing most of the important subjects which have been brought before the Académie during the year. The prizes awarded in 1881 are then reported, with the remarks of the commissioners in each case, and the programme of the prizes proposed for the years 1882 to 1886 is then published,—*Athenæum.*

M. Antoine Alexandre Brutus Bussy, the chemist and physicist, who was born at Marseilles in 1794, died at that place on the 4th of February. Bussy was created a doctor in 1832. He became director of the School of Pharmacy, and he was elected a free member of the Academie des Sciences in 1850. M. Bussy was one of the editors of the *Journal de Pharmacie.* In 1833 he published "De quelques Produits Nouveaux obtenus par l'action des Alcalis," and, connected with MM. Orfila and Olivier in 1846, he aided in producing "Reponse aux Ecrits de M. Raspail sur l'Affaire de Tulle." Bussy also superintended the translation of Faraday's "Chemical Manipulation."

Novel Reactions of Milk.—If a little tincture of guiacum is added to fresh milk a blue colour is produced. Milk heated to 80 degrees or upwards remains uncoloured. Sour milk takes the same tint, but the reaction is prevented by the addition of mineral acids and alkalies. If a little starch-paste mixed with potassium iodide is added to milk which has been mixed with old oil of turpentine, a fine blue band appears at the surface of contact and spreads rapidly. Milk freed from albuminous matter does not give this reaction. If to fresh milk there is added first acetic acid to precipitate the caseine, then some caustic potassa, and lastly a trace of a solution of copper sulphate, the violet reaction characteristic of peptone does not appear, but if the milk is allowed to stand fifteen to twenty hours before this treatment, the violet colour is obtained. The author considers the blue colour due to ozone.—*Chemical News.*

THE SCIENTIFIC REVIEW
AND
Scientific and Literary Review
INCORPORATING THE "JOURNAL OF THE INVENTORS' INSTITUTE."

MARCH, 1882.

WORK FOR THE INVENTORS' INSTITUTE.

THE recent untimely decease of the late President, Sir ANTONIO BRADY, as already narrated in this journal, was felt by all concerned as a great loss happening at a time when all the arrangements of the Institute should be in perfect order. The Executive Council anxiously considering the question and placing itself in conference with the general body of the members, came to the conclusion that if an eminent member of the House of Lords who understood the Patent Law question could be induced to take its leadership it would be most desirable.

Now, although there is neither law nor practice to confine the Presidentship to Vice-Presidents or Members of the Institute, yet, fortunately there was amongst the Vice-Presidents His Grace the DUKE OF MANCHESTER, who had in the early days of the Society been most active, and had remained ever since a member, and so upon urgent solicitation he agreed to become President as announced by Admiral SELWYN, who published the acceptance of the Duke to the meeting of the 2nd March, 1882.

With the DUKE OF MANCHESTER as President, we may hope for the early and practical development of the main object of the Institute, the reform of the Patent Law being kept under attention—its practical operation, its defects or abuses, and how, whilst preserving rights, wrongs may be remedied or prevented. These matters, which are obviously of the highest importance, are best promoted by the collective deliberations of those whose personal experience renders their opinions authoritative, and so valuable data can thus be obtained, and the Institute placed in a position to afford the Government information on which it may rely, and also to submit to Parliament proposals conducive both to the interests of Inventors and the public good.

Endeavours to keep its Members well-informed of any proposals which may affect their interests as Inventors and Patentees, and, if necessary, to represent and give public expression to their views on any alterations that may be contemplated or proposed in the Laws relating to Patents, will, we trust, be well met.

We trust that this journal will in future obtain additional important proceedings of the Institute in the Papers read at its meetings, with the discussions to which they give rise; articles on important and especially on current subjects; new Inventions and discoveries in science and manufacture throughout the world; answers to correspondents; and, in a word, every kind of information valuable to men of Science, Manufacturers, and Inventors.

Furthermore, we may expect these meetings so frequently held during the first six and last two months in each year, at which it is competent for its Members, in accordance with the regulations of the Institute, to promulgate their Inventions, and to bring forward subjects of general interest to Inventors, for consideration and discussion, to sustain their high character. And whenever sufficient funds shall be subscribed, the proposition to establish a Library containing Scientific and useful Works of Reference, which shall at all times be available for the use of the Members of the Institute; also to hold periodical exhibitions of Inventions for the inspection of Members and their friends at the rooms of the Institute, or at such other place as may be deemed expedient; and to organise courses of Lectures by eminent men, on subjects interesting or useful to Inventors.

The advent of a new President leads one to glance over the list of the names of those standing in any official position to the Inventors' Institute, and to consider whether there are not amongst the ordinary members names which for long membership and eminence should be added thereto. It must be remembered the Society embraces :

The President.—His Grace the DUKE OF MANCHESTER.

Vice-Presidents.—Sir Thomas Fairbairn, Bart., Beresford Hope, Esq., M.P., Robert Richardson, Esq., C.E., Admiral Jasper Selwyn, R.N., Cromwell F. Varley, Esq., F.R.S., Sir Henry Bessemer, C. Williams Siemens, Esq., C.E., D.C.L., F.R.S.

Executive Council.—The Vice-presidents above named and Messrs. F. H. Varley, W. H. Barlow, F.R.S., Dr. J. McGrigor Croft, J. P. Cutts, J. Greenfield, D. J. McLauchlan, T. Morgan, T. Patterson, T. Ransome, C.E., M. Zingler, F.C.S., F. W. Campin, F.R.S.L., (Sec.)

General Council.—The Vice-Presidents, the Executive Council, and Alexander Allen, Esq., C.E., T. Aveling, Esq., P. W. Barlow, Esq., C.E., F.R.S., M. P. W. Boulton, Esq., F. Braby, Esq., F.C.S., &c., Samuel Chatwood, Esq., D. K. Clarke, Esq., C.E., Dr. Robert H. Collyer, F.C.S., W. Conisbee, Esq., General Sir A. Cotton, K.C.S.I., &c., H. C. Coulthard, Esq., C.E., A. A. Croll, Esq., Robert Davison, Esq., C.E., William Dempsey, Esq., C.E., John Farmer, Esq., J. Faulding, Esq., C.E., C. Finzel, Esq., H. A. Fletcher, Esq., C.E., F.R.A.S., G. W. Hemans, Esq., C.E., W. T. Henley, Esq., Alexander Mitchell Innes, Esq., W. Mitchell Innes, Esq., Dr. H. C. Jennings, Dr. P. W. Latham, M.A., S. C. Lister, Esq., Walter Macfarlane, Esq., John Mackintosh, Esq., George Frederick Muntz, Esq., A. Normandy, Esq., W. H. Preece, Esq., C.E., J. L. Pulvermacher, Esq., T. W. Rammell, Esq., John Ramsbotton, Esq., C.E., John Saxby, Esq., A. Sedley, Esq., E. Sonstadt, Esq., Berger Spence, Esq., Peter Spence, Esq., G. P. Tangye, Esq., Robert Wheble, Esq., Hume Williams, Esq., W. N. Wilson, Esq.

The Secretary.—F. W. Campin, Esq.

Hon. Auditor.—J. Cutts, Esq.

Acting Treasurer.—G. A. Stretton, Esq.

We think that every one of the above list is a good name and that at the next members' meeting a few good names could be added.

Proceedings of Societies.

ROYAL SOCIETY.

JAN. 12.—The President in the chair.—The Right Hon. H. Fawcett, M.P., and the Right Hon. Sir G. W. W. Bramwell were elected Fellows.—The following papers were read: "On the Results of recent Explorations of Erect Trees containing Reptilian Remains in the Coal Formation of Nova Scotia," by Dr. J. W. Dawson.—"On the Variation of the Electrical Resistance of Glass with Temperature, Density, and Chemical Composition," by Mr. T. Gray,—and "On a New Electrical Storage Battery (Supplementary Note)," by Mr. H. Sutton.

JAN. 26.—The President in the chair.—The following papers were read: "On a Series of Salts of a Base containing Chromium and Urea," by Mr. W. J. Sell, "On the Spectrum of Water," No. II., by Profs. Liveing and Dewar, "An Attempt at a Complete Osteology of *Hypsilophidon Foxii*, a British Wealden Dinosaur," by Mr. J. W. Hulke, and "The Influence of Stress and Strain on the Action of Physical Forces, Part II. Electrical Conductivity," by Mr. H. Tomlinson.

FEB. 2.—The President, followed by the Treasurer, in the chair.—Mr. H. F. Blanford was admitted into the Society.—The following papers were read: "Sur les Surfaces Homofocales du Second Ordre," by Capt. A. Mannheim, and "On Measuring the Relative Thermal Intensity of the Sun, and on a Self-Registering Instrument for that purpose," by Dr. Frankland.

FEB. 9.—The President in the chair.—The Right Hon. H. Fawcett was admitted into the Society.—The following papers were read: "Note on Mr. Russell's Paper 'On Certain Definite Integrals, No. X.," by Mr. W. Spottiswoode, and "Report of an Examination of the Meteorites of Cranbourne, Australia; of Rowton, Shropshire; and of Middlesbrough, in Yorkshire," by Mr. W. Flight.

GEOGRAPHICAL SOCIETY

JAN. 16.—Right Hon. Lord Aberdare, President, in the chair.—The following gentlemen were elected Fellows: Rev. J. Jones, Rev. W. S. Price, Messrs. T. A. Clark, H. G. Guinness, J. W. Jervis, C. MacGill, H. M. Richards, W. S. Smith, E. Walley, and T. A. Ward.—The following papers were read: "A recent Journey through the Rovuma Country," by Mr. J. Thomson,—and "Makua Land, between the Rivers Rovuma and Lull," by the Rev. C. Maples.

JAN. 30.—Sir R. Alcock, V.P., in the chair. — The following gentlemen were elected Fellows: Major A. W. Baird, Major H. S. Clarke, Col. W. Davies, Rev. W. L. Lang, Messrs. H. Cundey, J. H. Davis, R. I. Finnemore, W. A. Green, H. P. Read, E. Reclus, and H. Spensley.—The paper read was "Across Iceland by the Springisandr Route," by Mr. C. E. Peek.

FEB. 13.—Right Hon. Lord Aberdare, President, in the chair.—The following gentlemen were elected Fellows: The Earl of Dysart, Major C. Wyndham Murray, Col. F. R. W. Sibthorp, Rev. A. Wild, Messrs. C. E. De Rance, P. Fenwick, A. J. Gayne, J. A. Jackson, H. T. Munro, J. A. Pybus, and F. Young.—The paper read was "On the Geography of the Birthplace and Cradle of the Mahratta Power in Western India," by Sir Richard Temple, Bart.

ASTRONOMICAL SOCIETY

JAN. 13.—Mr. J. R. Hind, President, in the chair.—Major E. S. Gordon, Capt. M. Salt, Rev. W. J. Wilby, Messrs. Escombe, T. Hands, J. N. Harrison, A. Morris, S. H. Parkes, G. E. Rankin, and I. Roberts were elected Fellows.—Mr. Christie read several papers, describing observations of the transit of Mercury of November 7th, 1881. Mr. Ellery, of Melbourne, observing with an 18-inch refractor, saw a white spot at the centre of the planet's disc during the whole time it was upon the sun; no distortion of the disc of Mercury was observed at ingress or egress. Mr. Tebbutt, who observed at Windsor, New South Wales, with a 4½-inch refractor, saw no black drop at egress; while the planet was upon the sun he saw a white spot at the centre of the planet's disc, but could not detect a brighter halo around the planet or any satellite. Mr. Maunder read a paper on the employment of photography in observing the transit of Venus of 1882. He said that during the coming transit the solar activity would be near to its maximum, and there is, therefore, a high degree of probability that a fair number of spots and faculæ will be visible. Venus will cross the sun at about 42° south heliographic latitude, and the limb of the planet will extend as far as 37° south latitude. This is not beyond the limit at which spots are occasionally seen; and though it is scarcely probable that Venus will pass over a spot she may probably pass over faculæ. The object of the paper was to suggest that under-exposed photographs should be taken at the various stations by which the parallax of the planet as observed upon such solar details may be determined.—The President said, "As a member of the Transit of Venus Committee of the Royal Society, I think I may say that there has been a general feeling that photography should not be employed again; but it would not be too late now to make arrangements to use the photographic method partially. I think the suggestion of great value. I may mention that I have received a letter from Prof. Winnecke, in which he says he is still able to follow, with the 20-inch refractor of the Strasbourg Observatory, the bright comet which was seen in June and July. It has a diameter of 30″, and its nucleus is equal in brightness to a star of the thirteenth and a half magnitude."—Mr. Glaisher read a paper, by Mr. J. Watson, giving an account of an observation of the two satellites of Mars with a 12-inch refractor.—Mr. Christie read a paper, by Mr. L. Swift, of Rochester, U.S.A., on the visibility of the Merope nebula; he suggested that the reason why the nebula had not been seen by Mr. Burnham and some other observers using large apertures was that the eye was dazzled by the light collected from stars in the neighbourhood.—The following papers were also announced and partly read: "The Relative Motions of the Great Red Spot and Brilliant Equatorial Spot on Jupiter," by Mr. M. F. Denning,—"Phenomena of Jupiter's Satellites and Occultations of Stars by the Moon observed at Stonyhurst Observatory," by the Rev. S. J. Perry,—"Observations of Deimos made at the Royal Observatory, Greenwich, 1881," by the Astronomer-Royal,—"Remarques sur la Méthode proposée par M. le Prof. Pritchard pour la Mesure de l'Eclat des Astres," by M. Loewy,—and "Madras Observations of Jupiter's Satellites and Observations of the Outer Satellites of Mars made at the Royal Observatory, Greenwich," by the Astronomer-Royal.

FEB. 10.—Annual General Meeting.—Mr. J. R. Hind, President, in the chair.—Messrs. H. J. Bell and A. Hilger and the Rev. H. G. B. Hunt were elected Fellows.—The annual report was read, from which it appeared that only one minor planet was discovered during the year 1881: this was found by Herr Palisa, of Vienna. Seven comets were observed during the year 1881. The first was discovered by Mr. Lewis Swift on April 30th. The second was discovered by Mr. Tebbutt in Australia; this was the first of the two large comets which were observed everywhere in the northern hemisphere. The third comet of the year was discovered in America by M. Schaberle, of Ann Arbor Observatory; [this] was the second of the two large comets. The fourth was Encke's comet; the fifth a small comet discovered by Mr. Barnard, of Nashville, Tennessee; the sixth is an interesting periodical comet discovered on the morning of October 4th by Mr. Denning, at Clifton. It is found to have a period of 3070·7 days, and its orbit passes near to the orbits of Venus, the earth, and Mercury; it will, therefore, probably be affected by considerable perturbations due to these planets. The seventh comet was discovered on November 16th by Mr. L. Swift, of Rochester, U.S.A. America thus claims the discovery of four of the seven comets which have been observed during the year.—The President delivered an address on presenting the gold medal of the Society to Mr. D. Gill for his heliometric observations of Mars, made at Ascension, and his discussion of his results. After reviewing the early attempts of Cassini and Flamsteed to determine the sun's distance by observations of Mars at opposition, he proceeded to give an account of Mr. Gill's expedition to the Island of Ascension, and of his method of making and reducing his observations. According to the determination of the parallax obtained by Mr. Gill, the earth's mean distance from the sun is 93,080,000 miles. The medal was handed to the Earl of Crawford, as Foreign Secretary, to transmit to Mr. Gill at the Cape of Good Hope.—The following gentlemen were declared to be elected as Officers and Council of the Society for the ensuing year: President, E. J. Stone; Vice-Presidents, J. C. Adams, W. H. M. Christie, J. R. Hind, and H. J. S. Smith; Treasurer, F. Barrow; Secretaries, J. W. L. Glaisher and E. B. Knobel; Foreign Secretary, the Earl of Crawford and Balcarres; Council, Sir G. B. Airy, J. Campbell, A. Cayley, A. A. Common, G. H. Darwin, W. Downing, E. Dunkin, W. Huggins, G. Knott, A. Marth, E. Neison, and A. C. Ranyard.

GEOLOGICAL SOCIETY.

JAN. 11.—Mr. R. Etheridge, President, in the chair.—Messrs. W. J. C. Ross, J. W. Brown, W. Hunter, H. Tomlinson. and C. O. Trechmann were elected Fellows.—The following communications were read: "On the Chalk Masses or Boulders included in the Contorted Drift of Cromer, their Origin and Mode of Transport," by Mr. T. M. Reade,—"Observations on the Two Types of Cambrian Beds of the British Isles (the Caledonian and Hiberno-Cambrian), and the conditions under which they were respectively Deposited," and "On the Devono-Silurian Formation," both by Prof. E. Hull.

JAN. 25.—Mr. R. Etheridge, President, in the chair.—Messrs. J. Blaikie and M. E. Jobling and the Rev. S. A. Pelly were elected Fellows.—The following communications were read: "On the Fossil Fish-remains from the Armagh Limestone in the Collection of the Earl of Enniskillen," by Mr. J. W. Davis, "On an extinct Chelonian Reptile (*Notochelys costata*, Owen) from Australia," by Prof. Owen, and "On the Upper Beds of the Fifeshire Coal-Measures," by the late Mr. E. W. Binney and Mr. J. W. Kirkby.

FEB. 8.—Mr. R. Etheridge, President, in the chair.—Messrs. R. Henderson, W. John, and J. R. M. Robertson were elected Fellows; and Prof. S. Lovén, of Stockholm, a Foreign Member.—The following communications were read: "Description of some Iguanodon Remains discovered at Brook, Isle of Wight, indicating a New Species, *Iguanodon Seelyi*," by Mr. J. W. Hulke, and "On a Peculiar Bed of Angular Drift on the High Lower-Chalk Plain between Didcot and Chilton," by Prof. J. Prestwich.

SOCIETY OF ANTIQUARIES.

JAN. 12.—Mr. H. Reeve, V.P., in the chair.—This being an evening appointment for the ballot, no papers were read.—The following gentlemen were elected Fellows: Bev. R. S. Mylne, Rev. F. E. Warren, Rev. R. M. Blakiston, Rev. G. Ward, Rev. T. Calvert, Messrs. O. Roberts, S. T. Rigge, J. D. Chambers, J. Ward, T. Fry, R. B. Mackie, W. H. Thomas, H. Griffith, F. G. H. Price, H. S. Harland, and C. H. Read.

JAN. 26.—Mr. E. Freshfield, V.P., in the chair.—The following gentlemen were appointed auditors of the Society's accounts for the past year:—Messrs. W. G. L. Gower, H. C. M. Lyte, P. C. Hardwick, and C. E. Keyser.—Mr. W. S. Weatherley exhibited and presented a lithograph of a drawing of an effigy of John the Baptist in Henry VII.'s Chapel, in continuation of a series already presented to the Society by the same gentleman.—Reports were laid before the Society by Mr. R. S. Ferguson and Mr. W. Jackson on the archæology of Cumberland, for which county those gentleman are local secretaries to the Society.—The Rev. H. J. Cheales exhibited an imperfect urn and numerous pieces of broken pottery, found in cavities which he had explored on the south-east coast of Lincolnshire, and which he believed to be middens of very great antiquity.—Canon Greenwell, however, observed that he believed, from the specimens exhibited, that they were of no very ancient date. The urn, in particular, bore evident traces of having been made on a wheel, and could not, therefore, be a British, much less, as Mr. Cheales seemed to intimate, a pre-British, production. Most of the fragments of pottery seemed to him to be mediæval.

STATISTICAL SOCIETY.

JAN. 17.—Mr. J. Caird, President, in the chair.—Prof. Leone Levi read a paper "On the Economic Progress of Italy during the last Twenty Years, since the Establishment of the Italian Kingdom."—Messrs. H. M. Paul, R. D, Urlin, E. J. Pearson, F. Jourdan, R. Hamilton, Sir R. W. Rawson, and the Cavaliere Giuseppe Buzzegoli took part in the discussion which followed.

MATHEMATICAL SOCIETY.

JAN. 12.—Mr. S. Roberts, President, in the chair.—Dr. G. J. Allman and Mrs. Bryant were elected Members, and Mr. G. H. Stuart was admitted into the Society.—The following communications were made: "The Invariants of a certain Orthogonal Transformation, with special reference to their Use in the Theory of the Strains and Stresses of an Elastic Solid," by Mr. W. J. C. Sharp,—"Some Formula in Elliptic Functions," by the Rev. M. M. U. Wilkinson.—"Complete Determination of the Real Foci, and of the Vector Equation, of a given Ellipse with respect to any Proposed Point," by Prof. Wolstenholme.—and "On the Calculation of Symmetric Functions," by Mr. J. Hammond.

FEB. 9.—Mr. S. Roberts, President, in the chair.—Mr. J. H. Tompson was elected a Member, and Mrs. Bryant was admitted into the Society.—Mr. Tucker read a short abstract of a paper, by Mr. H. M. Jeffery, "On Plane Curves of the Fourth Order with Quadruple Asymptotes."—The chairman communicated some results connected with Euler's formula connecting the sum of the divisors of a number with the pentagonal numbers, and remarked that the formula really expressed the equality of the sum of the divisors to the sum of the m^{th} powers of the roots of a certain equation.—Mr. Hammond and Mr. Tucker also made short communications.

PHILOLOGICAL SOCIETY.

JAN. 20.—Mr. A. J. Ellis, President, in the chair.—Dr. Murray made his yearly report on the Society's Dictionary.

FEB. 3.—Dr. Murray in the chair.—Mr. W Ridgway was elected a Member—Mr. J. Vogin's "Observatiuns on dhe Partial Correctiuns of English Spellings approovd by dhe Filolojical Society," was read by Mr. H. Sweet. Mr. Vogin commented on each of the Society's changes, complaining of some, and approving of others. He would spell would, *wulld;* onion, *unyun;* stomach, *stummac;* of, *ov;* could, *cwd*, &c. He would keep a difference of spelling where there was a difference of meaning.—Mr. Sweet read his paper "Notes on Points in English Grammar," the definition of a pronoun, special and general adjectives.

SOCIETY OF ARTS.

JAN. 26.—Dr. E. Frankland in the chair.—A paper "On Recent Researches into the Theory of the Living Contagium, and their Application to the Prevention of certain Diseases in Animals," was read before the Section of Applied Chemistry and Physics by Dr. T. L. Thudichum.

JAN. 30.—Sir F. Bramwell in the chair.—The first of a course of Cantor Lectures "On Recent Advances in Photography," was delivered by Capt. Abney.

FEB. 1.—Mr. G. Godwin in the chair.—Eight candidates were proposed for election as Members.—A paper "On Stained Glass Windows," was read by Mr. L. F. Day.

FEB. 13.—Sir F. Bramwell in the chair.—Capt. Abney delivered the third of the course of Cantor Lectures "On Recent Advances in Photography."

FEB. 15.—Mr. T. W. Boord in the chair.—Thirteen candidates were proposed for election as Members.—A paper "On the Art of Turning," was read by Mr. J. N. Hasluck.

PHYSICAL SOCIETY.

JAN. 28.—Dr. Stone in the chair.—Mr. W. L. Carpenter was elected a Member.—Mr. T. Wrightson read a paper, by himself and Prof. C. Roberts, "On the Fluid Density of the Metals Bismuth, Copper, Lead, Tin, Silver, Iron."—Mr. C. V. Boys exhibited models of apparatus invented by himself for measuring efficiency; and also a new electric current meter.—Capt. Abney made some new experiments in phosphorescence, in which he showed that the red end of the spectrum extinguishes the phosphorescence of Balmain's luminous paint.—Prof. Guthrie also exhibited an illustrative experiment with sulphide of calcium tubes.

FEB. 11.—Annual General Meeting.—Prof. W. G. Adams in the chair.—The annual report of the Council and the Treasurer's report were read.—The election of the office bearers for the ensuing year appointed Prof. R. B. Clifton to the presidency.—The meeting was then constituted an ordinary one. Prof. Clifton took the chair, and a paper was read by Dr. C. R. A. Wright, "On the Relation between the Electromotive Force of a Daniell Cell and the Chemical Affinity involved in its Action."

FOLK-LORE SOCIETY.

JAN. 27.—Mr. A. Nutt in the chair.—The Rev. J. Sibree, jun., read a paper "On the Oratory, Songs, Legends, and Folk-tales of the Malagasy." After giving a sketch of what had been done hitherto to give in an English dress the traditional lore of Madagascar, Mr. Sibree pointed out that it was only within the last five or six years that a large mass of folk-tales had come to light, and his object in this paper was to reproduce in English extracts from a book of some size published in Madagascar by the Rev. Louis Dahle, of the Norwegian Lutheran Mission, and also from the publications of the Malagasy Folk-lore Society. Specimens were then given of the different branches of folk-lore treated of in these works, commencing with oratorical flourishes or figures of speech, which are largely employed by the Malagasy in their public speaking. These abound with figures and similes, sometimes expanded into an allegory, and present many striking illustrations of native ideas and habits of thought on all kinds of subjects. Examples were next given of native conundrums and riddles; of songs, some addressed to royalty, as well as ballads, canoe ditties, and funeral chants; kabarys, or public speeches; children's games, some remarkably like those played by English children, such as "Oranges and Lemons," "Fox and Geese," &c., and songs and ditties intended to help in learning to count; and fabulous animals and goblins. Time prevented the speaker from doing much more than allude to the folk-tales proper. One or two of the shorter tales were, however, given, and the outlines of some half-dozen briefly sketched. One or two of these tales are of considerable length, and in their fullest form would make a good-sized book. Many are fables, chiefly referring to animals; some are mythic, professing to explain the origin of man and nature; some are giant stories, in which a monster named Itrìmobé is a prominent actor; and some partake of the character of nursery rhymes. There are several examples also of stories of men turning into animals, and then devouring and ravaging towns and districts until destroyed by superior cunning or stratagem.

ARISTOTELIAN SOCIETY.

JAN. 9.—Mr. S. H. Hodgson, President, in the chair.—Mr. T. Whittaker and Mr. A. M. Ogilvie were elected Members.—A discussion then took place upon "Necessity," and its dependent ideas, possibility and impossibility, uniformity, and "Physical, Logical, and Moral Necessity."

JAN 23.—Mr. S. H. Hodgson, President, in the chair.—Mr. W. A. Casson read a paper "On the Logic and Metaphysic of Aristotle," which was followed by a discussion.

FEB. 6.—Mr. S. H. Hodgson, President, in the chair.—A discussion took place "On Contingency and its dependent Ideas, Chance, Freedom, Indifference, and Uncertainty.

ROYAL SOCIETY OF LITERATURE.

FEB. 1.—Sir P. de Colquhoun in the chair.—Sir C. Dickson read a paper "On Dr. Faustus and the Legends connected with Him," which had been contributed by Sir P. de Colquhoun. In this paper it was contended that Dr. Faustus was unquestionably an historical personage, as his death is mentioned by Gesner, who compares him to Paracelsus, and as he is referred to in Luther's "Table Talk." The oldest account of Faust, in which it is stated that he was born at Roda, near Weimar, goes back to the year 1587.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

FEB. 1.—Mr. T. Morgan in the chair.—Mr. R. E. Way exhibited a collection of Roman pottery found in the excavations now in progress in King's Arms Yard, Southwark, a site which has already yielded a number of similar antiquities. The site has been apparently occupied extensively in Roman times, and we have thus so much additional evidence that Southwark was an important part of Roman London. The fragments shown included examples of almost every ware usually found on Roman sites, including black upchurch and lustred ware.—Mr. W. Smith described a bone implement, found at Bedford at a great depth in the earth, remarkable from its having incised lines and other patterns, apparently the work of prehistoric times.—Mr. C. H. Compton exhibited an inscribed scarab of early Egyptian work of great beauty.—Mr. E. P. Loftus Brock exhibited a heavy plaque of bronze with figures beneath an architectural canopy, the composition being very similar to that on the base of the column of Theodosius at Constantinople.—The first paper was on the stone circle at Duloe, Cornwall, by Mr. C. W. Dymond, and was illustrated by a carefully prepared plan of the remains from an actual survey. The circle has been described by various writers with but little regard to accuracy. The dimensions are small, being but forty-four feet from stone to stone in the greatest diameter, and there are but eight stones, the dimensions of each being given in exact detail. The site is an elevated one, and the pure white material of the stones must have made the monument a very visible object when the country was more open than at present. There is no appearance that the stones were ever covered over by a mound, as is the case with similar stone circles elsewhere.—A paper on "Screw Dollars," by Mr. H. S. Cuming, was read; and an interesting example of these rare coins, cut open, with a portrait enclosed, was exhibited by Mr. H. J. Swayne. The portrait was within a continental coin of the middle of the seventeenth century. Discussion ensued with respect to the nationality of the personage represented.

ARCHÆOLOGICAL INSTITUTE.

FEB. 2.—Mr. J. Hilton in the chair.—Mr. J. H. Middleton read some notes on Ashburnham House and the site it occupies. The paper described the various remains of the Abbey buildings at Westminster which form part of Ashburnham House—remains of all dates, from the eleventh to the eighteenth century—and the many changes of ownership which the house and its site had undergone were enumerated. The present house was built by Sir John Ashburnham about 1630, and there is distinct evidence to show that Inigo Jones was the architect.—The following resolution was carried unanimously: "That this meeting, having heard Mr. J. H. Middleton's statement of the historical importance of those portions of Westminster Abbey which, by the operation of the Public School Act, are taken from the Dean and Chapter and transferred to Westminster School, and it being evident that great alterations, if not entire rebuilding, will be necessary to adapt them permanently to the uses of the school, is of opinion that it is highly desirable that they should remain in the hands of the Dean and Chapter, to whose purposes they are already suited, and in whose hands they would practically be safe."—Mr. F. C. J. Spurrell described the collection of shallow pits on the north coast of Norfolk, and added accounts of similar large groups, such as the Pen pits, and others in various parts of this country and abroad. He pointed out that these great collections of pits, in contradistinction to minor collections, were all, so far as he knew at present, connected with the earliest traces of the use and manufacture of iron. Taken as a whole, he did not doubt that these places were dwellings and true hut-circles, and that they could be distinguished from iron or stone mines. The simplicity of their construction, and the comparatively slight traces of permanent occupation in some instances, denoted their temporary use, and showed that they were the shelters and dwellings of tribes collected together for limited periods (probably in summer), and the paucity of relics of utensils, &c., denoted poverty. It was possible that some of them might represent the huddling together of a population driven to extremity by an invading host, such as the Romans. In comparison with the largest groups of the true stone age, they suggest a great increase in the population in general.—Mr. Spurrell exhibited a large collection of palæolithic flint implements from new situations, recently found in the gravels of the Thames, and Darent, and Medway in Kent.—Mr. Middleton laid before the meeting a large plan of Westminster Abbey, showing the site of Ashburnham House.—The Rev. H. Kempson exhibited a parcel-gilt silver pomander, late sixteenth century work, of the highest beauty, opening out into eight segments, each forming a box with a sliding lid, inscribed for different scents. When closed this object presents a surface delicately ornamented with naked figures and foliage chased in silver.—Mr. H. S. Harland sent a roughly chipped flint "skinning" knife from Yorkshire.—Mr. G. M. Atkinson exhibited an early eighteenth century repeater watch in a pierced and engraved silver case.—From Mr. A. E. Griffiths came a first instalment of portions of British urns and bones lately found at Hampton Wick.—Mr. Spurrell exhibited a small pewter cup, shaped like a posset-pot, and contained in an embossed and gilt leather case.

LINNEAN SOCIETY.

FEB. 2.—Mr. C. B. Clarke, V.P., in the chair.—The Rev. B. Scortechini and Mr. J. Marshall were elected Fellows.—Mr. T. Christy exhibited various vegetable fibres and the manufactured pulp obtained therefrom by Mr. C. Ekman's process, whereby excellent paper can be made quickly and economically from all sorts of coarse plant fibre.—An extract of a letter from Mr. T. Edward, of Banff, was read, and a fragment shown of a supposed rare marine animal got by a fisherman in deep-sea water.—Dr. Murie identified it as belonging to the Nemertean Worms, viz.:—*Cerebratulus angulatus*, a marine form found chiefly on the northern parts of the British coasts, but seldom seen alive by naturalists.—Mr. E. M. Holmes exhibited specimens of a new blistering insect from Madagascar, belonging to the genus Epicauta and allied to *E. ruficollis*. Mr. Holmes afterwards drew attention to specimens of chinchona bark cultivated in Bolivia, belonging to the "verde" and "morada" varieties of Calisaya, which deserve notice on account of the large yield of bark and good percentage of quinine; they therefore pay the Bolivian planters better than *Ledgeriana calisaya*.—Mr. J. R. Jackson exhibited a specimen of the Australian native "Pituri" bag. Formerly the leaf of the plant was only known, but Baron von Mueller has lately shown from other evidence that it is derived from *Duboisia Hopwoodii*. A note by Mr. O. Tepper, on the medical use of *Melaluca uncinata*, R. Br., was read. He says the dried leaves chewed and swallowed are a specific in colds, sore throat, and bronchitis, their flavour being aromatic.—A communication from Major-General Benson was read, referring to Dr. Cobbold's use of the name *Fasciola Jacksoni* for certain flukes obtained from the elephant.—Then followed a paper by Mr. R. Fitzgerald, "Botanical Sketch in connection with the Geological Features of New South Wales." How has the distribution of the vegetation originated? That the Australian continent has risen slowly is gathered from numerous proofs, among others the horizontality of the strata being very manifest. In its uplifting the outer rim of the continent was slightly more elevated than the interior, and what between a once inland sea, marshes, and mud, a once probable greater rainfall, all, and especially the latter, produced the present physical features. Whence the coal seams? Are they not the remains of vegetation borne from a continent lying eastward, whereof New Zealand, Norfolk and Howes Island are but vestiges? The most typical group of Australian vegetation is the Proteaceæ, found chiefly in the sandstone or poor country. It is a very ancient family, extending back to the secondary period of geology, since which Australia has never been submerged. The remarkable close gradation of species of the Banksias, &c., point out no loss of connecting links, as would have happened had submergence and elevation occurred. Were the Epacrids once a family of trees, the living species being decadent examples? The Casuarineæ are undoubtedly an ancient family, and, like conifers, flourished in the dawn of life. The nettles and palms, inhabitants of the eastern coast range, possibly may have had an Asiatic origin, through the Malayan Archipelago. The sassafras, tree ferns, and myrtles, growing on the cold mountain scrubs, hold a conspicuous place, and evidently had an Australian derivation. The Compositæ and Chenopodiaceæ (salt bushes) found in the interior plains are rapidly disappearing, the small species giving place to introduced grasses and weeds. As regards acacias and eucalyptus, they have the widest distribution and most complicated genera. They both appear to be at their zenith, having existed long enough to pass into redundant forms, but not long enough to have been exposed to vicissitudes and decline. Their absence from New Zealand and Norfolk Island implies they did not belong to the eastern submerged continent, nor are they old enough to be found with the laurel and other remains of the gold drift.—A paper was read containing "Observations on Animal Intelligence," by Mr. O. Tepper.

THE INSTITUTION OF CIVIL ENGINEERS.

FEB. 7.—Sir W. G. Armstrong, President, in the chair.—It was announced that the Council had recently transferred Messrs. D. S. Baynes, J. Brown, W. B. Myers, and J. M. Wrench to the class of Members; and had admitted twenty-three Students.—At the monthly ballot twelve Members, thirty-two Associate Members, and one Associate were elected.—The paper read was "On the Candle-power of the Electric Light," by Dr. P. Higgs.

FEB. 14.—Sir F. Bramwell. V.P., in the chair.—The paper read was "On Air-Refrigerating Machinery and its Applications," by Mr. J. J. Coleman.

ROYAL INSTITUTION.

FEB. 6.—Mr. G. Busk, Treas. and V.P., in the chair.—The Earl of Dysart, Mrs. A. Hamilton, and Mr. S. Biddell were elected Members.—Dr. W. Bowman was elected Honorary Secretary, and Dr. Warren De La Rue was elected Manager.

SOCIETY OF BIBLICAL ARCHÆOLOGY.

FEB. 7.—Dr. S. Birch, President, in the chair.—A communication was read "On the Birds of the Assyrian Records and Monuments," by the Rev. W. Houghton.—A communication was presented from Mr. P. Le Page Renouf, "On the Wrong Values commonly assigned to Hieroglyphic Groups."—A communication from Prof. W. Wright was read "On the Siloam Inscription."

NEW SHAKESPERE.

JAN. 13.—Mr. F. J. Furnivall, Director, in the chair.—The following papers were read and discussed: "On Suicides in Shakspere," by Rev. J. Kirkman. The writer pointed out that the actual suicide was of small account compared with the mental conflict that led up to it. Most instructive, too, were the cases which did not end in suicide, but, we may say, ought to, as Richard III. and Macbeth. We should note the contrast in this matter between Hamlet and Ophelia; Hamlet thinks a thousand suicides, but commits none—Ophelia thinks none, but "wilfully seeks her own salvation." The one case is a palpable antithesis to the other.—"Constance," by Mrs. J. H. Tucker.—A paper by Mr. C. H. Herford.

THE CANDLE-POWER OF THE ELECTRIC LIGHT.

By Dr. Paget Higgs.

At a recent meeting of the Institution of Civil Engineers, the President, Sir W. G. Armstrong, C.B., F.R.S., in the Chair, the above Paper was read.

Very diverse statements, it was remarked, were constantly before the public as to the candle-power of various devices for affording electric light. As these statements appeared to be incompatible, an attempt would be made to evolve some order from the figures relating to the electric light. The most salient point for a unit of comparison was the number of heat-units represented by electrical measurement, as in ratio with the candle-power measured optically. But at the outset a difficulty, or rather an uncertainty, was experienced; this referred, however, only to arc-lights, of which there were two systems of measurement—one with the carbons on the same axis, the other with the axis of one of the carbons forming a very acute angle with the axis of the other carbon, so that the glowing crater of one carbon formed a reflector to the point of the other. In the latter case, considering the light of the former as unity, the light might be about 1-66 times stronger as measured. This had been pointed out by Mr. Douglass, M. Inst. C.E,, in a Report to the Trinity House. Another source of discrepancy was the want of knowledge of the specific heat of the vapour of the electric arc, and of its temperature; if one were known the other could be determined. Taking the ratio of units of heat represented per candle-power, the subsequent figures would show a large margin of economy for arc lighting over incandescent lighting. This would of course be true of the arc considered only as a furnace producing a greater heat in a smaller space than by incandescence; and it appeared to the author to be true for another reason. Whatever might be the specific heat of the vapour of the electric arc, it was certain that over the given resistance of the arc, as compared with an equal resistance of the incandescent lamp, the mass of the arc, measured by the molecules it contained, was far less than that of the solid carbon.

Supposing a light of 1000 candle power, measured with the carbons on the same axis, produced with 4·5 ohms. resistance and 10 webers of current, there would be represented 108 gramme-degrees of heat, or nearly 0·1 gramme-degree per candle power per second. This was deducible from the figures given by the Brush system. It did not include the heat due to consumption of carbon in air, which was inconsiderable. In a Siemens lamp, tested by the author, about 3000 candle-power, of diffused beam, was obtained with 36 webers current, when the lamp had 1 ohm of resistance in the arc. This corresponded to 335 heat-units, or 0·112 unit per candle-power. In a Serrin lamp, fed from a Gramme machine, the author obtained a light of 3600 candle-power with 45·7 webers current, the arc having 1¼ ohm resistance, corresponding to 624 heat units, or 0·17 unit per candle. A Crompton lamp, fed by a Burgin machine, gave a light said to be of 4000 candle power; but assuming this to be from bi-axial position of the carbons, about 2000 candle-power would correspond to 180 heat-units for 16 webers on 2·93 ohms, or 0·09 heat-unit per candle power. On (about) the same resistance of arc in a Crompton lamp, 24 webers yielded the author 3600 candle-power, or about 403 heat-units, corresponding to 0·12 heat-unit per candle-power.

As 1 gramme-degree equal 42 million ergs, 1 candle-power represented 4·9 million ergs. As a foot-pound was 13·56 million ergs, each candle-power represented 0·364 foot-pound per second, or, 1511 candle-power perHP., a rough check upon the forgoing figures. The late Mr. L. Schwendler had stated in a Paper (fragmentary to the author) that the standard candle did work at the rate of 610 meg ergs in a second, whilst the unit of light was produced electrically at the rate of not more than 20 meg-ergs in a second. At the trials at the Franklin Institute, when only 380 candle-power per HP. were obtained, there was estimated to be 1·6 gramme-degree = 67 megergs per candle-power. Mr. Schwendler's figures were, therefore, now at a long discount. However, the figures given in this Paper were intended to be only intercomparative.

Another type of lamp, the Werdermann, might be termed an arc-incandescent lamp, because the light was obtained from the incandescence of a cone of carbon resting at its apex on a negative electrode of larger section, and from the arc that played between the sides of the carbon-cone and face of the negative electrode. Ten of these lamps, giving 40 candle-power light, each burning 4-5-millimetre carbons, yielding about 0·88 heat-unit per candle-power. A series of these lamps averaged 306 candle-power, with 50 webers current, the resistance of each lamp being 0·1337 ohm. This corresponded to 80 heat-units per lamp, or to 0·262 heat-unit per candle-power. Thus, where the small light was a sub-multiple to a considerable degree of the larger light, want of economy commenced to be evident, and an average could no longer be taken. A Joel lamp, one of a series of ten, was said to have afforded 320 candle-power, with an electromotive force of 130 volts, sending a current of 50 webers through the series, corresponding to 156 heat-units per lamp, or 0·49 heat-unit per candle-power.

These notes, however crude, had more weight when purely incandescent lamps came to be considered. In this case measurement was easy, for the light approximated in colour to that of the standard candle employed, and the resistance of the incandescent fibre was sufficiently constant to yield concordant results. One of Maxim's earliest lamps was measured by the author and found to indicate 3·6 ohms when cold, and 1·9 ohm when giving 11·5 candle-power light with a current of 5·5 webers. This corresponded to 0·83 heat-unit per candle-power, or about 140 candle-power per HP. It should be remarked that with this current the loss due to heat per unit of resistance in the conductors would be 3 per cent. as against the 0·1 per cent. for a weber current. Another Maxim lamp of about 64 ohms when giving 50 candle-power, and 116 ohms when cold, with 1·3 weber current, would correspond to 0·52 heat-unit per candle-power. An Edison lamp, in the author's possession, measured 61 ohms when cold and 33 ohms when hot, and indicated, with 1 weber of current, 11 candle-power, equivalent to 0·73 heat-unit per condle-power. A Swan lamp had not, at the time of the author's measurements, found its way to America; but there were several statements as to the candle-power of this lamp. It would appear, that with 160 volts and 24 webers of current, twenty-four rows of two lamps in series, or forty-eight lamps, each of 84 ohms resistance, gave 48 candle-power each. Assuming that this was the resistance of the lamp when cold, that the resistance when incandescent would be 33 ohms, and that there would then be 2 webers passing through each lamp, this would correspond to 0·66 heat-unit per candle-power. These were, however, assumed figures.

It should be clearly understood, in estimating the work done in any carbon focus, that the resistance of the carbon decreased with increase of temperature, and that if the current were directly taken from a dynamo-machine, constructed on the mutual accumulation principle, there would be considerably more current flowing through the lamp than an estimate based on a potential measurement would allow, It was at present impossible to estimate the loss due to decrease of resistance in ths carbon, by expenditure of heat, but it must be considerable. The author hoped that from this it would appear in how far the incandescent light was theoretically more costly than the arc-light, as about 6 to 1. But in practical use there were other considerations, not the smallest of which was the attendance arc-lights required to maintan their store of carbon

The light employed for ordinary domestic purposes was approximately 1 candle (standard) at 1 foot distance. Assuming an average distance of 8 feet for domestic lighting, the electric chandelier must be of 64 candle-power to give the same "surface-intensity," in a room 16 feet square and of slightly more than ordinary height. The incandescent lamp would give this light at an expenditure of 0·6 heat-unit per candle-power, or 38·4 heat-units per light-centre, or say four chandeliers per HP. A 5-feet gas-burner supplying 16 candle-power light would cost for a 4-light chandelier, for 20 cubic feet of gas, in New York 2·50 dols. × 0·02 = 0·05 dols. or 5 cents an hour. At 40 dols. a year cost, or adding 25 per cent. for profit, at 50 dols. a year, 1 HP. could be had for about 300 working hours a year, and $\frac{5000}{300} = 16{\cdot}6$ cents an hour, or $\frac{16{\cdot}6}{4} =$ 4·15 cents per hour for the electric chandelier. This showed that, even now, were a reasonable commercial profit taken, the electric light, in the United States at least, could compete with gas.

A paper by Sir William Thomson and Mr. Bottomley, entitled "The Illuminating Powers of Incandescent Vacuum-Lamps, with Measured Potentials and Measured Currents," read at the last meeting of the British Association, contained a table from which a valuable law could be deduced, a law that the Author first enunciated before the Institution in 1878. It was that the light in an electric system varied as the fourth power of the current whose resistance or potential was constant, or as the second power of the work in circuit. The value of the candle-power in heat-units was higher than observed by the Author. This was probably due to the method employed in measuring the light, which was more wasteful of the observed rays than that used by the Author. Considering that in the measuring galvanometer, although a very accurate instrument, the deflections were merely proportional to the effect, the liability of error would be small: and that in the photometer used (an inaccurate instrument) the measurements varied with the second power of the distance, whilst the light under measurement varied with the fourth power of the current, the departures from agreement of the observed and estimated figures might be fully ascribed to errors of observation.

RECENT AMERICAN AND FOREIGN PATENTS.

A practicable and very useful improvement in *drag saws* has been patented by **Mr. Marion L. Nichols**, of Center Township, Mich. This invention relates to portable sawing machines, and is more particularly applicable to sawing trees or logs. It may be operated by hand through a crank or handle and suitable gearing connected with a reciprocating saw. The invention consists in a combination with the main frame of a saw carrier adjustable about a vertical pivot on a block supported by horizontal trunnions on top of the main frame, locking nuts and convenient adjusting devices being provided to hold the saw carrier in any desired position. The apparatus may be used to saw either vertically, horizontally, or in any intermediate direction, or it may have a universal motion. The feed of the saw may be effected by moving its carrier with one hand while the other hand is applied to reciprocating the saw.

Mr. Ludwig Silland, of Edwardsville, Ill., has patented an *improved harrow*. In this improvement the harrow proper is made up of several interchangeable duplicate sections. The invention consists in the peculiar construction and arrangement of the draught devices and connecting links, whereby the draught can be applied to two or more sections of the harrow as desired. To this end the draught beam is transversely divided into two sections united by detachable plates. One of these sections is permanent and the other removable. On the permanent section, at about the middle of the length of the entire beam, is an eyebolt, and near either end of the beam are corresponding eyebolts. A link connects the eyebolt at the end of the removable section with a central draught ring that is attached by a hook to the central eyebolt fast on the permanent section. Said ring is also connected by another hook with a second ring which is attached by links to the middle and end eyebolts on the permanent section of the beam. By this construction, when it is desired to use three harrow sections, the pull is made on the central ring, but when the removable section of the beam and one harrow section are detached, then the hooks are disengaged and the draught is made on the other ring. The invention has much merit.

A strikingly novel improvement in *pillows and bolsters* has been patented by Mr. William T. Doremus, of New York city. The object of this invention is to prevent the stuffing of pillows and bolsters from being crowded out of place by pressure applied to parts of the said pillows and bolsters. The invention consists in a pillow or bolster formed of a central roll surrounded by two or more parallel rolls, connected with the said central roll along its sides. This not only prevents the stuffing from being crowded out of place by use, but the pillow can be adjusted for the head to rest upon one of the surrounding rolls or in the space between two rolls. Some of the rolls may be made harder than others, and thus allow the user a harder or softer support for his head.

An improvement in *children's carriages*, which is valuable for the safety it secures, has been patented by Mr. Hiram Seaman, of New York city. The object of the invention is to prevent accident from the wheels of the carriage running over obstructions, and also by rolling down inclines when the carriage is unattended. The invention consists in hanging the forward axle of the carriage at its centre on a spindle which projects from the forward end of a longitudinal rod that connects at its back end with the rear axle of the carriage. By this construction either front wheel is free to rise in passing over an obstruction without tilting the carriage body, and the forward axle can be turned to anchor the carriage.

An improved *sectional steam boiler*, which is economical of fuel, quick to generate and superheat steam, easy of repair, and occupies but little ground room, has been patented by Mr. Milton W. Hazelton, of New York city. The body of the boiler consists of a central upright cylinder provided with a series of radiating tubes, closed at their outer ends and arranged in successive planes one above the other, the tubes and spaces of the several series alternating with each other. A series of vertical tubes are set in the spaces between the outer ends of said radiating tubes, and arranged to extend from near the water line above these tubes to the bottom of the central cylinder, and communicating at their ends by horizontal pipes with said cylinder. A tubular water jacket is formed around the fireplace by a double series of vertical and horizontal pipes connecting with the central cylinder, and the steam chest, at top of the boiler, is fitted with vertical smoke-flues for superheating the steam.

Mr. Charles Ebel, of New York city, has patented an *improved hydrant*. This invention provides, in a very simple and effective manner, for emptying the nozzle pipe of a hydrant of water in cold weather, to prevent injury from freezing. To this end the stem of the valve which controls the admission of water to the nozzle pipe is extended downward below said valve, and carries on its lower end a reverse valve which, when the nozzle pipe valve is closed, opens communication between a lower extension of the nozzle pipe and a waste chamber, which is arranged below it, and which is fitted with a pipe that connects with the sewer, thus allowing any water that may be left in the nozzle pipe to run off. A separate valve is used to close this pipe that connects with the sewer whenever it is not necessary to empty the nozzle pipe, as, for instance, during warm weather.

An improved *car coupler*, which is simple, strong, and durable, and allows of the cars being coupled and uncoupled without dangerous exposure to life or limb, has been patented by Mr. Oliver S. Riggs, of Allenport, Pa. This invention relates to that class of couplers called "self-couplers;" and it consists of a flaring mouthed drawhead containing a pivoted elbow drop-catch for engaging the coupling link, held down by rod and spring and raised by lever, and containing, also, a curved plate rigidly secured in rear of the drop catch for guiding the coupling link and holding down its engaged end, The lever which raises the drop-catch is an elbow one arranged on the exterior of the drawhead, and may have attached to it a rod extending forward for the engineer to uncouple the cars while in motion.

Mr. William Johnstone, of Ottawa, Canada, has patented an improved *steam boiler*. This invention consists in a combination with an upper cylindrical chamber, which forms both a water and steam receptacle, of an annular lower water chamber surrounding the grate, upright water tubes connecting said chambers and forming the exterior wall of the boiler, drop tubes for containing water depending from the upper chamber into the fire chamber, and a series of short upright tubes which connect the upper and lower chambers. This constitutes a cheap and efficient boiler for generating steam for mechanical uses, for heating dwellings, and for other purposes.

An improved *boat lowering and detaching apparatus*, which is both rapid and safe, and is automatically released when the boat touches the water, has been patented by Mr. Albert Willis, of Colusa, Cal. The invention consists in an upright at each end of the life-boat, to the top of each of which uprights a short arm or beam is pivoted, the loose end of which passes into an aperture in a beam pivoted to the lower end of the upright, this upper beam being held in the aperture by a safety chain and by a pintle pasing through a ring attached to a string or chain fastened to the davit, whereby when this string is drawn taut by the descending of the boat the ring pulls the pintle out of its aperture, so that the lower beam can drop when relieved of its strain—that is, when the boat floats—thus permitting the upper arm to swing upward and the ring of the pulley block to slide from a hook on the upper pivoted beam, thereby causing the boat to be detached from the pulley.

An improvement in *fishing reels* has been patented by Mr. John Palmer, of New York city. The invention consists of a fishing reel provided with an extensible crank for increasing the length of leverage when necessary when reeling in the line, the extension arm being adapted to be withdrawn to shorten the lever to ordinary length while casting out the line.

An improved combined *button lop* and stap for garments has been patented by Mr. David W. Thompson. of Englewood, Ill. The invention consists in the combination, with the garment or body piece having simply a straight slit cut in it where the opening is to be, of a single piece of material, which, when folded and stitched to the sides of said slit, constitutes both an upper and under botton lap or fly, a facing, and a stay for re-enforcing the bottom of the opening, making a finished piece of work without raw edges.

Punches.—Mr. Henry H. Norrington, of West Bay City, Mich., has patented an improvement in the class of punches or perforating stamps designed for use in banking and other similar establishments for the purpose of puncturing or cutting out portions of a check or other written instrument to prevent fraud by alteration. This invention has obtained Letters Patent of the United States for stamps or punches of this class, and the present invention is in the main an improvement upon that which forms the subject of patent No. 223,161, granted to the same inventor December 30, 1879.

Shuttle-boxes.—Messrs. Levi L. Lukens, of Chester, and Henry Holcroft, of Media. Pa., has patented an improvement in shuttle boxes for looms which consists in a peculiar construction and arrangement of the parts, by which the second spindle, as ordinarily used, is dispensed with, which permits of an increasing width of the picker strap. There are other points in the invention which cannot be properly described without an engraving.

Paint Cans.—An improvement in the class of machines adapted for soldering the heads of paint cans and other cylindrical vessels to their bodies has been patented by Mr. Henry R. Robbins, of Baltimore, Md. It is more particularly an improvement in machines which are adapted for using solder wire, the lotter being wound upon a reel, from which it may be drawn off as required and fed into contact with the heated soldering irons and can seams. In this machine the wire reels and mechaniam for drawing off the wire are operated simultaneously with the rotation of the can by means of friction gearing, which is put in operation by treadle mechanism. The soldering appliances are also arranged for a certain simultaneous and automatic action. The soldering irons are pivoted and adapted to vibrate between the can-holders and an open furnace, so that they may be swung forward to press on the can seams, and backward to enter the furnace, where they are heated preparatory to the next operation.

Mr. William Hassel, of Brussels, Ill., has patented an improved *animal shears*. The device comprises a sharp-edged toothed plate arranged to slide on a similar sharp-edged toothed plate which is adjustably fastened to a like toothed bed-plate. This bed-plate has a rigid handle that is provided with a spring which presses against a handle pivoted to the bed-plate, and which has a connecting bar pivoted to its upper end. This connecting bar is attached to a strip arranged to slide in a longitudinally slotted guide plate on the bed plate, and having the sliding knife-plate adjustably fastened to it. In this improved shears for clipping wool, &c., a clean cut, with but little risk of injury to the animal, is practicable, and the cutting blades of plates of the instrument may readily be removed when required to be sharpened or replaced.

A novel improvement in *bathing tubs* has been patented by Mr. Henry Costello, of Brooklyn, N.Y. The invention consists of a corrugated or roughened plate or band of rubber, fabric of wool, horsehair, or other suitable material, permanently or adjustably fixed in or on the sloping back-piece of the tub, where the bather's back naturally rests, so that by gently moving the body from side to side the bather may, with little effort, rub, and cleanse his back. In some instances said plate may be an insulated metal one, and an electric current be passed through it, which will have a therapeutic effect on the bather.

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